KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
COLLEGE OF COMPUTER SCIENCES & ENGINEERING

COMPUTER ENGINEERING DEPARTMENT

COE-202 – Fundamentals of Computer Engineering
November 25th, 2008 – Major Exam #1

Student Name:
Student Number:
Exam Time: 90 mins

- Do not open the exam book until instructed
- The use of programmable calculators and cell phone calculators is not allowed – only basic calculators are permitted
- Answer all questions
- All steps must be shown
- Any assumptions made must be clearly stated

Question No.	Max Points	
1	60	
2	20	
3	40	
4	40	
Total:	160	

Q.1) (60 points) Mark the following statements with either TRUE (T) or FALSE (F)

1	Transmission of decimal signals compared to binary signals has more resolution and therefore more reliable.	
2	The quantity r^n where is $r = 16$ and $n = 4$ is equal to $(10000)_H$.	
3	For any value of X, $X.\overline{X}$ is always equal to 1.	
4	The distributive property for the AND operation means that $X(YZ) = (XY)Z$.	
5	The expression $X + \overline{X}Y$ s equal to $X + \overline{Y}$.	
6	V_{IL} is defined as the maximum input voltage level for Logic 1.	
7	For a logic gate, the maximum tolerable noise margin for logic 0 is estimated by V_{IL} - V_{OL}.	
8	If the Boolean function $F(X,Y,Z)$ that is equal to $\sum m(0,2,5,7)$, then its complement is equal to $\prod M(0,2,5,7)$.	
9	Higher performance computing systems require gates with higher propagation delays.	
10	More fanin for CMOS gates typically mean larger propagation delays.	
11	Outputs of tri-state gates can be connected together.	
12	The number $(185)_{10}$ is equal to (0001 1000 0101) in BCD while it is equal to (1011 1001) in binary.	
13	Odd and even parity are used for signed number representations.	
14	Grey coding is used for error control (detection and correction).	
15	Unicode is a 16-bit character code that accommodates characters of various languages of the world.	
16	V_{OH} is defined as the minimum output voltage that considered a Logic 1.	
17	The propagation or speed limit of a gate is a function of electrical current drawn from the gate for both the TTL and CMOS technologies.	
18	ASCII codes contain printable and non-printable (control) characters.	
19	For *n*-bit binary integer representation using signed magnitude system, the minimum integer is negative $(2^{n-1} - 1)$.	

20	V_{IH} must be higher than V_{OH} to guard against noise signals.	
21	CMOS gates typically have lower number of inputs (fanin) compared to the corresponding gate from the TTL family.	
22	An overflow condition occurs in 2's complement arithmetic if the carry into the sign bit and the carry out of the sign bit are different.	
23	For a general unsigned number of *n* integer digits and *m* fraction digits in base *r*, the smallest number is r^n-r^{-m}.	
24	The Boolean expression A+BC is equal to (A+B)(A+C) always.	
25	The consensus theorem for three variables states that XY + X'Z + YZ = XY + X'Z.	
26	The sum of minterms expression is a special case from the sum of the products form for any Boolean function.	
27	For any *n*-input function, total number of minterns or maxterms is given by 2^{n-1}.	
28	The Boolean function $f(x,y) = \sum m(0,3)$ can simplified to a one product form.	
29	For an *n*-input variables Boolean function, the maxterm is a sum term.	
30	Prime implicants are product terms that may or may not be included in the final simplified expression for the Boolean function.	

Q.2) (20 points) Indicate *clearly* the best possible answer

1) Converting $(153)_{10}$ to base 8 yields which of the following results?
   a. 107
   b. 132
   c. 701
   d. 231
   e. 153

2) Converting $(1010111)_2$ to base 8 yields which of the following results?
   a. 531
   b. 721
   c. 44
   d. 135
   e. 127

3) Converting $(11011.01)_2$ to base 8 yields which of the following results?
   a. 33.2
   b. 63.2
   c. 63.1
   d. 33.1
   e. 63.01

4) Converting $(0.375)_{10}$ to base 2 yields which of the following results?
   a. .1011
   b. .110
   c. .1101
   d. .011
   e. .110111111

5) For n = 5, 10111 is the two's complement representation of:
   a. -23
   b. -9
   c. -7
   d. +22
   e. +7

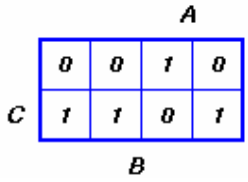
6) For n = 5, 00111 is the two's complement representation of:
   a. -23
   b. -9
   c. -7
   d. +22
   e. +7

7) For n = 5, 10100 is the two's complement representation of:

a. -11
b. +12
c. -12
d. -20
e. +20

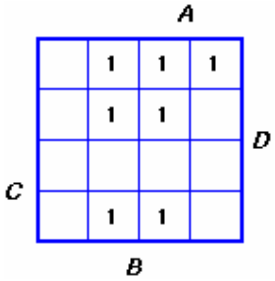
8) Identify the function which generates the K-map shown – Assume the order of the variables in the linear truth table is A (Most significant), B, and C (Least Significant):

a. F= Sum m(1,3,4,7)
b. F= Sum m(1,3,5,6)
c. F= Sum m(3,4,5,6)
d. F= Prd M(1,3,4,7)
e. F= Prd M(1,3,5,6)



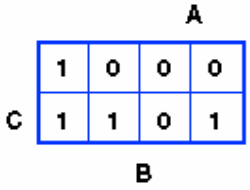
9) Identify the most simple SOP expression from the K-map shown.

a. B'C + AD + CD
b. BC' + BCD' + AC'D'
c. BC' + BCD' + AB'C'D'
d. AD + BCD' + CD
e. BC' + BD' +AC'D'



10) Identify the simplest POS expression which generates the K-map shown.

a. (A+C')(A+B+C)
b. (A+B)(A+C')(B+C')
c. (A'+B')(A'+C)(B'+C)
d. (A'+C)(A'+B'+C')
e. (A+B)(A'+C)(B'+C)



Q3) (40 points) A simple machine uses 3 hex digits to represent numbers. Let the used format be $A = A_1A_0.A_{-1}$.

a) (10 points) How many different representations or numbers does this machine have?

b) (5 points) Assuming a signed 16-complement system, what are the minimum negative number and maximum positive number the machine can handle?

c) (5 points) What does $(FF.F)_{16}$ correspond to?

d) (5 points) Assuming a signed 15-complement system, what are the minimum negative number and maximum positive number the machine can handle?

e) (5 points) What does $(FF.F)_{16}$ correspond to?

d) (10 points) Using 16-complement system, what is the result of $(F.5)_{16} - (1A.3)_{16}$?

Q.4) (40 points) Simplify the following Boolean function F

$$F(A,B,C,D) = \sum m(2,3,4,5,6,7,8,10,11,12,14,15)$$

a) **Plot the K-map for this function**
b) **Find all prime implications and essential prime implicants**
c) **Write all possible simplified SOP expressions for F(A,B,C,D)**
d) **Simplify F in the form of POS**